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# NUCLEAR WASTE

## Department of Energy's Hanford Tank Waste Project— Schedule, Cost, and Management Issues



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**Resources, Community, and  
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The Honorable Thomas J. Bliley, Jr.  
Chairman, Committee on Commerce  
The Honorable Joe L. Barton  
Chairman, Subcommittee on Oversight and Investigations  
Committee on Commerce  
House of Representatives

Cleaning up waste produced as a by-product of 50 years of supplying the nation's nuclear materials for weapons is a formidable challenge. The Department of Energy (DOE) spends over \$5 billion per year on its program to clean up radioactive and hazardous waste at its nuclear weapons production sites. The Hanford Site, located in southeast Washington State, has one of the greatest concentrations of radioactive waste in the world. One of the most difficult cleanup challenges at Hanford involves the 177 underground storage tanks holding highly radioactive liquid waste, sludge, and other materials. Cleaning up this waste is important because it poses a significant risk to the environment and to surrounding communities. Recently, DOE disclosed that waste leaking from some of the tanks has reached the groundwater and threatens the nearby Columbia River.

In 1996, DOE decided it would purchase waste treatment services through competitively awarded, fixed-price contracts to demonstrate treatment technologies and treat at least 6 percent of the waste. Under these contracts, competing contractors would finance, design, build, and operate temporary waste processing facilities and be paid on a per-unit basis if they successfully immobilized the waste for storage. DOE referred to this approach as its privatization strategy. However, on August 24, 1998, DOE signed a contract with only one contractor—BNFL, Inc. (BNFL),<sup>1</sup> a subsidiary of British Nuclear Fuels, plc., to design, build, and operate permanent facilities to treat about 10 percent of Hanford's tank waste.

In view of the billions of dollars that the government will spend treating this waste, at your request we assessed the implications of DOE's new approach. This report discusses (1) how DOE's current approach has changed from its original privatization strategy; (2) how this change has affected the project's schedule, cost, and estimated savings over conventional DOE approaches; (3) what risks DOE is now assuming with this

<sup>1</sup>DOE and BNFL signed a modification to an existing contract. For simplicity, we refer to this as a contract throughout this report.

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change in approach; and (4) what steps DOE is taking to carry out its project oversight responsibilities.

As a starting point for our review, we used the report DOE issued to the Congress in July 1998 outlining the proposed shift in its contracting approach. We supplemented this with on-site reviews at Hanford; reviews of DOE and contractor documents and plans; and discussions with DOE, contractor, and industry officials at Hanford and in Washington, D.C.

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## Background

Hanford's aging underground tanks contain about 54 million gallons of highly radioactive waste. Over the years, more than 1 million gallons of waste have leaked into the soil. DOE currently estimates the total cost of cleaning up the tank waste at more than \$50 billion (in actual year dollars). Since 1989, DOE has spent about \$3.5 billion on this effort. To convert the waste into a form for more permanent storage, the waste will be separated into high-level and low-activity components<sup>2</sup> and then, through a process called vitrification, converted into a glass-like material that can be poured into steel containers where it will harden. The immobilized high-level waste will be stored on-site for eventual shipment to a national repository, while the low-activity waste will be permanently disposed of on the Hanford Site.

DOE plans to use private contractors to conduct the vitrification work and over the last several years has developed a contracting approach. In February 1996, DOE issued a Request for Proposals for the tank waste project. DOE envisioned that under this approach, two contractors would build and operate demonstration facilities that would treat at least 6 percent of the waste. DOE referred to this part of the waste treatment effort as phase I. DOE estimated that phase I would last at least until 2007 and cost about \$3.2 billion for the two fixed-price contracts and another \$1.1 billion in contract support costs, for a total of about \$4.3 billion. In September 1996, DOE awarded a fixed-price contract for \$27 million to each of the two contractor teams to begin phase I by developing preliminary facility designs and other preliminary project plans. One team was led by BNFL and the other team was led by Lockheed Martin Advanced Environmental Systems (Lockheed). In phase II, contractors would compete for a contract to process the remaining tank waste.

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<sup>2</sup>Hanford's tanks contain highly radioactive waste. When separated into high-level and low-activity components, most of the waste will be low-activity radioactive waste. Low-activity waste has a wide range of characteristics, but most of it contains small amounts of radioactivity in large volumes of materials. The tanks also contain hazardous chemicals and heavy metals.

DOE's experience during the initial part of phase I led to a change in the contracting approach. In May 1998, after reviewing the preliminary designs and plans submitted by the two competing teams, DOE decided to continue phase I with only one contractor—BNFL. DOE and outside expert reviewers found that the approach set forth by the Lockheed team presented an unacceptably high technical risk in attaining DOE's cleanup goals, requiring additional development and using technologies that, in some cases, were largely unproven. In contrast, DOE concluded that BNFL's technical approach was sound, using technologies for waste treatment and vitrification that were well developed and had been used in other waste treatment situations. On August 24, 1998, DOE signed a fixed-price contract with BNFL to continue with phase I by developing an approach that would process at least 10 percent of Hanford's tank waste by 2017. The contract cost was estimated at about \$6.9 billion (in constant 1997 dollars). The contract is considered a fixed-price contract because DOE and BNFL agreed to a target fixed-price per unit of processed waste. This price may be adjusted in the year 2000 after technical aspects of the project become more clearly known. DOE estimated that its other costs related to supporting BNFL's efforts would be about \$2 billion, bringing the project's total estimated cost to about \$8.9 billion.

## Results in Brief

The project as currently envisioned is substantially different from DOE's 1996 initial privatization strategy. Although the project award was made on the basis of a fixed-price contract, further competition between contractors and short-term demonstration facilities have been eliminated in favor of more permanent facilities that could operate for 30 years or more and, therefore, would be available to treat additional tank waste. In addition, the design phase as well as the date when DOE and BNFL are to reach agreement on final contract price have been extended by 2 years to August 2000. BNFL's specific project financing arrangements which were to be established in May 1998 have been deferred until August 2000. In addition, to ensure that BNFL can obtain affordable private financing, DOE has agreed to repay much of the project debt if BNFL defaults on its loans and DOE terminates the contract. This is an unusual feature of a fixed-price contract because the government normally does not agree to pay a contractor's debt as an allowable cost. If this commitment were structured as a conventional loan guarantee, DOE would have had to estimate the potential subsidy cost over the term of the loans and have the budget authority to fund them before making the guarantee.

The revised approach extends the completion date for processing the first portion of the waste from 2007 to 2017, and total costs rise from \$4.3 billion to \$8.9 billion, including \$2 billion in DOE's support costs (in constant 1997 dollars). The increased costs are mainly the result of DOE's decision to build permanent facilities that will take longer and cost more to design and build, and the higher financing costs and contractor profits involved in operating these facilities over a longer period of time. However, DOE estimated that this approach would save 26 to 36 percent over contracting approaches it had used in the past, such as reimbursing a contractor for its costs plus an agreed-upon profit amount. Because of questions about DOE's methodology for estimating savings, considerable caution is needed in assuming how much the revised approach will save.

The revised approach represents a dramatic departure from DOE's original privatization strategy of shifting most financial risk to the contractor. The contract now calls for DOE to pay BNFL for most of the debt incurred in building and operating the facility if BNFL should default on its loans.<sup>3</sup> Thus, DOE faces a financial risk not initially contemplated on the project that could be in the billions of dollars. DOE agreed to assume this risk because it did not think BNFL would be able to obtain affordable financing unless the government provided some assurance that the loans would be repaid. Given that the project still has a number of technical uncertainties such as using waste treatment technology that has yet to be successfully tested at production levels on Hanford's complex and unique wastes, and management challenges such as obtaining needed contracting expertise, DOE's financial risks are significant.

In an attempt to avoid repeating past mistakes in managing large projects, DOE has identified additional expertise it needs and has developed several management tools to strengthen its oversight of the project. For example, DOE plans to have about an 80-member team to manage this effort, and it has taken a number of steps to plan for better coordination among BNFL, the contractors providing support services at Hanford, and its own staff. The success of the project, however, will depend heavily on how well DOE implements these plans. DOE has a history of not fully implementing its management and oversight plans, and there are some early indications on this project that DOE may be having difficulty ensuring that the proper expertise is in place and fully funding project support activities.

<sup>3</sup>Under the terms of the contract, if the lenders declare BNFL in default and accelerate the debt due, DOE will terminate the contract for default or for the convenience of the government. In this event, DOE will pay BNFL, as an allowable cost, the outstanding principal amount of the loans plus all accrued and unpaid interest, less certain other adjustments.

## DOE's Current Approach Differs Significantly From Original Project Strategy

DOE's August 1998 contract with BNFL is a substantial departure from DOE's original privatization strategy. DOE said its contracting approach evolved as it received feedback from private companies and financial advisors, as well as input from the two contractor teams that submitted proposals under the original approach. According to DOE, changes to its initial approach were made to optimize the technical approach and to make the project financially feasible or to reduce the likelihood of performance problems. These changes fall into four main areas: competition, financial issues, facility issues, and schedule revisions. Table 1 summarizes these changes, and the sections that follow discuss why DOE made them.

**Table 1: Summary of Major Changes to DOE's Privatization Contracting Approach**

Type of change	Old approach	New approach
Competition	Two contractors throughout phase I	One contractor
Financial issues-risk	Contractors provide equity and obtain private financing guaranteed by corporate assets	Contractor provides equity and obtains private financing but DOE commits to repay contractor's debt if contract terminates
Financial issues-payment	Payments made upon delivery of treated waste	Up to \$50 million interim payment made before waste is processed; remaining payments made upon delivery of treated waste
Financial issues-setting prices	Final price agreement set by May 1998	Final price agreement delayed 2 years to August 2000
Facilities issues	Contractors build temporary demonstration facilities to process 6% of Hanford waste by 2007	Contractor builds permanent production facilities to process at least 10% of Hanford waste by 2017
Schedule revision	Construction to begin December 1999	Design period extended; construction to begin July 2001

### Competition

Unlike DOE's original approach, the current approach is not competitive. Because DOE found that the approach set forth by the Lockheed team was unacceptable, DOE authorized only BNFL to proceed through the remainder of phase I. The extent to which competition will be present in phase II is unknown.

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## Financial Issues

DOE's approach to financing the project has shifted. Instead of requiring the contractor to obtain all needed financing without recovery from DOE if the project fails, DOE is now planning to repay BNFL's debts above its equity, insurance, and other limited funds if BNFL defaults on its loans and DOE terminates the contract. DOE officials said that the government's commitment to repay the contractor's debt was needed, in large part, to make the project financially feasible. DOE concluded that requiring 100 percent private financing without government backing of the private debt could increase the financing costs so much that the project would not be affordable. DOE also concluded that an increased governmental role in backing the debt would reduce the overall cost of the project, but DOE had no specific estimate of the amount of the reduced costs. Government backing of the private debt is an unusual feature for a fixed-price contract because the government normally does not agree to pay a contractor's debt as an allowable cost.

DOE has also shifted its financing strategy from providing payment to the contractor only upon delivering the processed waste, to one where BNFL may now receive a payment of up to \$50 million before waste processing begins.<sup>4</sup> DOE said that such interim payments will help reduce the total project cost by reducing long-term financing costs and providing an incentive for BNFL to reduce the actual costs of waste processing.

Finally, neither contractor was willing to commit to a fixed-unit price and schedule by May 1998 without adding significant contingency to the price. The August 1998 contract identified a target price and set August 2000 as the date at which the unit price will be fixed and BNFL's funding commitments will be established. DOE determined that this delay would strengthen the feasibility and economics of the project, although agency officials also indicated that information gained during this delay could also lead to increased prices.

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## Facility Issues

DOE is contracting for waste processing services that will be much different from what was initially envisioned. DOE originally planned that two contractors would build temporary waste processing facilities during phase I that would test each contractor's technological approach. These facilities were estimated to have a useful life of approximately 10 years and were considered "throw-away" buildings. According to DOE, both BNFL and Lockheed concluded that shorter-term, throw-away facilities were not

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<sup>4</sup>The payment includes a base amount of \$20 million for specific deliverables and an incentive fee based on the extent that BNFL is able to reduce the project's construction and operations costs or identify contract changes acceptable to DOE that will reduce the overall system cost.



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feasible and that longer-life facilities were needed to provide the required levels of safety, operability, and maintainability. The contract now requires the waste treatment facilities to be designed to operate for a minimum of 30 years and have the capability to increase capacity. DOE said that although this approach means much more expensive facilities than originally anticipated and, therefore, an increase in project costs for phase I, longer-life, expandable facilities allow DOE more flexibility and options in how the waste cleanup is completed.

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### Schedule Revision

In addition to more permanent, costly facilities, the new contract extends the design period and delays the start of construction about 19 months beyond what was originally planned. DOE expected that construction of the facilities would begin by December 1999. However, in their January 1998 proposals, both BNFL and Lockheed indicated that additional time was needed to further develop project design and plans for meeting regulatory and permitting requirements. The contractors believed that adhering to the original schedule would carry too many uncertainties, and that they would be unable to obtain needed project financing unless a more realistic schedule could be negotiated. DOE believes that the change will allow further design development before construction begins, thereby reducing the risks associated with design uncertainties.

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### Different Approach to the Project Extended Schedule and Increased Costs

Current schedule and cost estimates for the project are substantially greater than DOE's original estimates. In 1996, DOE estimated that in the first phase of the project, two contractors would process 6 percent of the waste by 2007 and up to 13 percent of the waste by 2011. DOE is now estimating that phase I will last until at least 2017, an extension of up to 10 years. Several interim steps in phase I also have revised completion dates.<sup>5</sup> (See table 2.)

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<sup>5</sup>Some of these dates are later than the dates DOE has agreed to with its regulators, the Environmental Protection Agency, and the Washington State Department of Ecology. DOE will need to renegotiate these dates with its regulators. One of the milestones, the date to start high-level waste processing, is earlier than the date agreed to with the regulators.



**Table 2: Changes in Estimated Schedule for Hanford's Waste Treatment Project**

	<b>Original schedule</b>	<b>Revised schedule</b>	<b>Extension (months)</b>
Contract modification signed	May 1998	Aug. 1998 (actual)	3
Fixed-unit price established	May 1998	Aug. 2000	27
Facility construction started	Dec. 1999	July 2001	19
Waste vitrification started	Dec. 2002	Feb. 2007	50
Waste processing completed	2007 <sup>a</sup>	2017 <sup>b</sup>	120

<sup>a</sup>DOE's original schedule required the contractors to process 6 percent of the waste by 2007. DOE had the option to extend waste processing an additional 4 years to 2011 to process a total of 13 percent of the waste, depending on the contractors' performance.

<sup>b</sup>DOE's funding schedule shows that the project will be funded only through 2017. Additional time will be required to deactivate the facilities.

One change in the project schedule was an extension allowing BNFL more time to design and construct permanent, more durable waste pretreatment and treatment plants. BNFL proposed extending the design phase by 24 months. BNFL reasoned that the additional design time would help reduce the risks associated with a fast-track design/construct project and was needed because more extensive structures were being proposed. BNFL's proposal to build more durable facilities with a longer useful life also required a longer construction time. BNFL proposed this approach, and DOE agreed to it, because (1) BNFL said that nuclear and worker safety requirements could not be efficiently incorporated into the demonstration facilities initially proposed and (2) permanent facilities provided advantages in processing the tank waste that would remain after phase I. The lengthened construction added about 4 years to the original schedule. Also, it will take BNFL about 10 years to process the waste, or about 5 years longer than if two contractors were doing so. In addition, BNFL included additional schedule contingency to deal with possible start-up and production problems.

Estimated costs for the project have also increased significantly. The total project costs for phase I, including DOE's support costs, increased from \$4.3 billion in the original estimate to process 6 percent of the waste to \$8.9 billion in the current estimate to process 10 percent of the waste, as measured in constant fiscal year 1997 dollars. (See table 3.)

**Table 3: Changes in Cost Estimates for Hanford's Waste Treatment Project**

Constant fiscal year 1997 dollars in millions

Cost element	Initial estimate	Revised estimate	Percent change
Contract price	\$3,200 <sup>a</sup>	\$6,960 <sup>b</sup>	+118
DOE support costs <sup>c</sup>	\$1,050	\$1,970	+88
Total costs	\$4,250	\$8,930 <sup>d</sup>	+110
Cost per metric ton of waste processed	\$0.76	\$1.5	+97

<sup>a</sup>Includes initial project costs.<sup>b</sup>Includes contract target price of \$6.93 billion, initial project costs to date, and a \$20 million fee for successfully completing project requirements and funding arrangements to begin facility construction.<sup>c</sup>Support costs are understated because they do not include the cost of the regulatory unit or federal personnel costs. These costs were not readily available.<sup>d</sup>This estimate does not include the potential cost to the government of a possible BNFL default on its loans with the private sector.

The waste processing facilities now being designed will cost nearly \$1 billion more to build than the demonstration facilities DOE originally proposed. Because of the longer period during which investors will expect a return on investments, equity and debt financing costs are expected to increase from about \$1 billion to more than \$3 billion.

### Cost Savings Estimate Must Be Viewed With Caution

As part of its revision of the project's cost and schedule, DOE analyzed whether the BNFL fixed-price approach was likely to save money when compared with two alternatives: a management and operations (M&O) contract or a cost-reimbursement contract with performance-based incentives. In July 1998, DOE estimated the range of savings under its revised approach for phase I at 26 to 36 percent when compared with these two alternatives. The savings estimate of 36 percent was based on comparing the proposed BNFL fixed-price approach with an M&O approach based on past Hanford management and operating contractor cost data; the estimate of 26 percent was based on a comparison with the estimated cost for BNFL to perform the work under a cost-reimbursement contract. Our review of DOE's most recent estimates indicate that the savings amounts should be viewed with considerable caution. For example:

M&O contracting approach should not be used as a comparison because an M&O contracting strategy is no longer an approach that DOE would seriously consider using. Until recently, DOE has generally used M&O contractors to

manage its facilities. DOE's M&O approach involved paying an on-site contractor for management and operating services regardless of what was accomplished. However, DOE is shifting to management and integration contracts involving performance measures and incentive-based contracts. DOE officials at Hanford told us that they used an M&O contract estimate because they had historical experience with M&O contracts and had an idea what the costs would be. However, we believe DOE's cost savings analysis could be more meaningful if it included a range of contracting options that DOE would actually consider using, such as various combinations of government and private financing. Because of the high cost of private financing on this project and DOE's agreement to assume the risk associated with the debt, direct federal funding of part or all of the project may actually lower total project costs without significantly increasing the government's level of risk.<sup>6</sup> DOE discussed government versus private financing in its report to the Congress on this project but did not present information on the differences in total project costs. According to DOE officials, during the next 2 years they will further evaluate the trade-offs between using government and private debt to determine the best overall mix of equity, debt, and government financing for the project.

Rough estimates are presented as precise numbers. Cost projections for two of the contract alternatives DOE considered in its analysis are based on what are called "rough order of magnitude" estimates. The margin of error for these estimates is plus or minus 40 percent, meaning that the actual cost could be up to 40 percent less than or greater than the estimate presented. Because the order of magnitude estimates are subject to so much variability, it is difficult to assign much credence to an overall savings estimate based on these numbers.

Cost growth estimates are not used consistently. For the comparison between a fixed-price contract and a cost-reimbursement contract with performance incentives, DOE assumed that cost growth would be 68 percent for the cost-reimbursement contract, and the fixed-price contract would have no cost growth. However, other evidence indicates

<sup>6</sup>For a discussion of alternative financing approaches and related risks, see Department of Energy: Alternative Financing and Contracting Strategies for Cleanup Projects (GAO/RCED-98-169, May 29, 1998).

that fixed-price contracts may have greater cost growth than cost-reimbursement contracts.<sup>7</sup>

Analysis does not reflect full range of cost savings estimates. Although the potential cost savings DOE reported to the Congress show a range of 26 to 36 percent, DOE documents supporting the analysis show a range of 10 to 36 percent. According to DOE's Director of the Office of Project and Fixed Asset Management, DOE did not disclose the lower number in its report to the Congress because it did not believe the lower number was adequately supported.

This is not the first time DOE has based cost savings on questionable analytical practices. In January 1997, we reported on the accuracy of the information DOE provided to the Congress to support the Department's fiscal year 1997 request for privatization funds. DOE claimed that six privatization projects had saved \$1.1 billion. However, we found that DOE had understated some project costs, used incorrect cost data, and made cost comparisons using projects of different scopes.<sup>8</sup> In addition, our 1996 report on Hanford's tank waste project also discussed the problems associated with DOE's practice of presenting rough order of magnitude numbers as point estimates.<sup>9</sup>

<sup>7</sup>DOE based the 68-percent figure on a study that found a 68-percent difference between two cost estimates—an estimate developed in the study assuming an M&O contracting approach and a government cost estimate for a privatized approach to the project. However, the study assumes that the M&O costs will be greater and uses judgment to estimate the amount of the increase in costs, rather than estimating the differences using actual historical data. (See DOE M&O Contractor Cost Estimate, Burns and Roe, June 1998.) Other DOE-commissioned studies have reached different conclusions about cost growth on DOE contracts by studying actual cost growth on DOE contracts. For example, a 1993 study of DOE's environmental management contracting and project management practices found that for a representative sample of contracts, the actual cost of fixed-price contracts exceeded the estimated costs by almost 75 percent. The primary cause of the cost increase was that fixed-price contracts were used on poorly defined projects, which led to changes during construction contributing to increased costs and schedule delays. In contrast, the study found that cost-reimbursement contracts exceeded the estimated costs by 35 percent. See Department of Energy, Office of Environmental Restoration and Waste Management, Project Performance Study, Independent Project Analysis, Inc. Reston, Va. (Nov. 30, 1993).

<sup>8</sup>See Nuclear Waste: DOE's Estimates of Potential Savings From Privatizing Cleanup Projects (GAO/RCED-97-49R, Jan. 31, 1997).

<sup>9</sup>See Hanford Waste Privatization (GAO/RCED-96-213R, Aug. 2, 1996).

## Revised Approach Shifts Significant Financial Risk to the Government

Under the revised contract approach, DOE faces a substantial financial risk that could be in the billions of dollars. This risk comes mainly in the form of an agreement to pay BNFL for much of the debt incurred in constructing and operating the waste treatment facilities if BNFL defaults on its loan payments and DOE terminates the contract. This agreement has the same practical effect as a loan guarantee and is a dramatic departure from the original privatization strategy.<sup>10</sup> If DOE had provided a guarantee for BNFL's loans from a private lender, the Federal Credit Reform Act would have required DOE to estimate the net present value of the subsidy cost of the loan guarantee over the term of the loan and to have budget authority available for this full cost before the guarantee could be provided. DOE officials told us they agreed to back BNFL's loans because lenders told DOE that BNFL would not be able to obtain affordable financing without it. The officials said the increased governmental role would likely reduce the contract's overall cost by allowing BNFL to borrow at lower rates.

So far, the amount of DOE's potential liability is unknown, because the amount of borrowing that will be covered under the commitment will likely not be determined until the contract price is established and financial closure occurs in August 2000. However, BNFL's vice president and project manager told us that DOE's potential liability could be as much as \$3 billion. He said that in the case of a default, \$3 billion is about the maximum debt that would be outstanding after BNFL's equity and contingency funds were applied.<sup>11</sup>

Apart from this financial risk, DOE also faces other financial risks that are not as significant as a default by BNFL, but could increase the project's overall price. For example, DOE is subject to making idle facility payments to BNFL if DOE is unable to supply waste from the tanks. Also, the contract contains provisions for renegotiating the agreed-upon price if certain changes occur that could affect cost or schedule, such as DOE's failure to provide required support services, changes in environmental law, or other

<sup>10</sup>DOE's agreement to pay BNFL its outstanding debt as an allowable cost if the contract is terminated is close to, but not the same as, a federal loan guarantee. DOE's agreement is a commitment DOE has with BNFL, not with BNFL's lenders, and therefore it does not meet the definition of a loan guarantee. A federal loan guarantee is provided directly to a lender, not to the borrower. Agencies need legislative authority to provide a loan guarantee.

<sup>11</sup>Debt for financing the project can be of two types: debt that is secured by BNFL's assets (called "recourse" debt) and debt that is secured only by the revenues BNFL expects to receive from treating the waste (called "nonrecourse" debt). The agreement between DOE and BNFL applies only to recourse debt. However, to this point, lenders appear reluctant to provide a significant amount of nonrecourse funding because of the project's numerous technical and operating risks. Thus, borrowing against assets is likely to be the main source of capital for the project. DOE's risk is made even more substantial because BNFL is a separate corporation from its parent company and, therefore, lenders may not be able to pursue BNFL's parent company in the event of a contract termination.

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events that are beyond the control of the contractor. Some of these risks would also exist under a more traditional contracting arrangement.

DOE's financial risks hinge on a number of factors that could potentially affect the project. We identified six main types of factors, which we believe merit continued attention as the project proceeds.

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## Unverified Technology

BNFL officials acknowledge that although the technology they plan to use has been successfully applied in other settings, it has been tested only on small amounts of Hanford waste in laboratories, and has not been used at production facilities to vitrify the unique types of waste at Hanford. Under DOE's original approach, the success of the selected technologies was to be demonstrated in temporary plants; in DOE's revised approach, permanent plants will be built. However, BNFL has developed various other approaches to deal with the need to ensure that the technology will work. These include conducting tests on certain aspects of the technology at existing facilities at other DOE sites and in the United Kingdom and constructing a prototype melter<sup>12</sup> for the low-activity waste vitrification process. These efforts are expected to continue as the vitrification facilities are being designed and built. BNFL has assured DOE that its technology will be fully tested and demonstrated before beginning operations of its full-scale, high-level waste treatment plant in February 2007 and its low-activity waste treatment plant in January 2008. To ensure that technologies are fully demonstrated, DOE expects to hire experts to review BNFL's demonstration plans and testing results. While DOE Hanford officials also expect DOE headquarters to commission an independent review of BNFL's testing results, no plans for this review have been developed.

Under its revised approach, DOE retains a significant part of the risk for the success of this technology. In the worst case, if demonstration activities fail or if they prove inadequate to ensure the success of full-scale operations, the overall project may fail, and DOE will be liable for paying off a significant portion of BNFL's debt after BNFL's resources are exhausted. If demonstration activities show that the technology is usable but flawed, treatment facilities may require expensive retrofitting to make them viable. This could raise the cost of the fixed-price contract that DOE will negotiate with BNFL.

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<sup>12</sup>The melter is a large furnace that heats the waste to a high temperature and combines it with other materials to produce a glass-like product.

## Rapid Plant Construction

Although the revised approach gives BNFL additional time to design the waste treatment and vitrification facilities, the schedule still poses some potential risk. To give BNFL more time to design the facilities, DOE set back the start of construction by about 2 years. However, even with this change, construction will begin well before all of the design work is completed. BNFL officials estimate that overall design work will be less than 50 percent complete at the start of construction.

DOE and BNFL officials expressed confidence in the time line of the revised approach. The officials said that the schedule is comparable to other nuclear facilities BNFL has successfully built and operated. However, BNFL officials also acknowledged that conducting simultaneous design, construction, and technology testing carries some risk. To reduce this risk, BNFL performs a periodic risk assessment to ensure that design and technology testing concerns will be addressed as quickly as possible in the next 24 months. Because of our experience in analyzing similar schedules that have contributed to problems on other DOE projects, we believe that the construction schedule is a potential factor affecting DOE's risk. Specifically, DOE projects such as the Defense Waste Processing Facility at Savannah River, the Pit-9 cleanup project at the Idaho National Engineering and Environmental Laboratory, and the Spent Fuel Storage Project at Hanford<sup>13</sup> experienced cost overruns and schedule changes that suggest designs should be developed enough to mitigate such results.

There do not appear to be agency or industry guidelines on the extent to which facility designs for complex, one-of-a-kind nuclear processing facilities like vitrification plants should be complete before construction begins. In an analysis of an earlier DOE proposal to build a waste vitrification plant at Hanford, we raised similar concerns about concurrent design and construction and pointed out that for an advanced light water reactor, the Electric Power Research Institute recommended that construction not begin until the detailed design is 90 percent complete.<sup>14</sup> A manager of the Institute's Nuclear Power Group told us that advanced light water reactors are similar in complexity to a vitrification plant.

<sup>13</sup>See *Nuclear Waste: Defense Waste Processing Facility—Cost, Schedule, and Technical Issues* (GAO/RCED-92-183, June 17, 1992), *Nuclear Waste: Department of Energy's Project to Clean Up Pit 9 at Idaho Falls Is Experiencing Problems* (GAO/RCED-97-180, July 28, 1997), and *Nuclear Waste: Management Problems at the Department of Energy's Hanford Spent Fuel Storage Project* (GAO/T-RCED-98-119, May 12, 1998).

<sup>14</sup>*Nuclear Waste: Hanford Tank Waste Program Needs Cost, Schedule, and Management Changes* (GAO/RCED-93-99, Mar. 8, 1993).



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## Safety and Regulatory Issues

Another factor potentially affecting the success of the project—and therefore DOE's financial risk—is whether the safety and other regulatory requirements can be successfully met. For example, DOE's Regulatory Unit raised 90 issues with safety documents that BNFL submitted in January 1998. DOE's manager of the Regulatory Unit described the quality of the BNFL safety documents as "poor" and said that the next set of safety documents, submitted in August 1998, was also poorly done. These latter documents were subsequently withdrawn by BNFL. The DOE manager said that problems with safety documents could affect the project schedule and cost and that BNFL needed to make immediate improvements in its approach to safety. Several additional safety documents are required before BNFL can begin construction of the facilities in the year 2001. Unless the required safety documentation is approved, BNFL will be unable to start construction on schedule. DOE's Regulatory Unit is working to prevent problems we found on two recent major projects—the Pit 9 project in Idaho and the Spent Fuel Storage Project at Hanford—where problems with the safety basis of the work delayed project schedules and caused additional rework.

The BNFL project manager attributed the safety documentation problems primarily to the early level of project design and said that BNFL will greatly increase the staff addressing safety-related issues during the rest of phase I. BNFL also has recently hired an experienced nuclear facilities licensing manager to lead this effort. DOE has also taken steps to help ensure that BNFL is addressing safety issues. For example, DOE has negotiated into the contract provisions which (1) require periodic meetings between its regulatory staff and BNFL to discuss safety issues and (2) provide for DOE attendance at BNFL's safety committee facility design review meetings.

The project also presents another regulatory challenge. DOE planned to have the Occupational Safety and Health Administration (OSHA) regulate worker safety at the plant. However, in May 1998, OSHA declined to assume responsibility, citing a need first for statutory and regulatory changes to be in place, as well as a full complement of the resources required. If OSHA does not regulate worker safety, then DOE must do so. The manager of DOE's Regulatory Unit said that if this issue is not resolved by January 2000, his unit will assume responsibility for regulating worker safety so that construction can begin on schedule.

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## DOE's Support Activities

DOE is responsible for the following major support activities: sampling and analyzing tank waste (characterization); providing infrastructure, which

includes roads, water, electricity, and wastewater treatment; retrieving waste, which requires DOE to retrieve waste from the tanks and deliver it to BNFL while keeping the chemical makeup of the waste within specified ranges; and storing and disposing of waste after processing, which requires DOE to temporarily store the high-level waste and permanently store low-activity waste. DOE estimates that support activities will cost about \$2 billion including about \$600 million for waste retrieval, \$40 million for characterization, and about \$370 million for waste storage and disposal. Although support activities are essential to project success, many of them are still in the planning stages, and potential problems are not yet apparent. At this time, the areas that appear to be most prone to problems are waste retrieval and waste storage and disposal.

DOE's ability to successfully retrieve waste for processing depends, among other things, on the availability of double-shell tank space for storage and transfer activities. According to DOE and contractor officials, double-shell tank space is a major uncertainty because double-shell tanks are also being used for other cleanup activities at the site. If the capacity needed for waste storage exceeds the space available in the 28 double-shell tanks, DOE's ability to supply waste to the private contractor for processing will be affected.

The storage of immobilized high-level waste in Hanford's canister storage building poses another risk to DOE's ability to successfully support the project. The risk is that the installation of equipment and subsystems needed to store immobilized high-level waste in the canister storage building could conflict with a schedule for another DOE project—storing spent nuclear fuel removed from its current deteriorating storage facilities.

DOE's site support contractor concluded that these two problems have a high risk of adversely affecting the project. As a result, DOE could have to make idle facility payments. In response, the site support contractor identified a set of mitigating actions that it believes will reduce the risk that the problems will adversely affect the project.

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## DOE's Funding Stream for the Project

DOE's ability to fund the project within its own budget is an important factor in ensuring that lack of funding does not lead to project termination. DOE estimates that it will need more than \$10 billion in actual year dollars from fiscal year 1999 through 2017 to fund the \$6.9 billion project cost—an average of \$537 million annually. During 7 of those years, payments to BNFL are expected to exceed more than \$1 billion per year.

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This funding represents a substantially increased need for funding at the Hanford Site, where current annual budgets for all on-site cleanup activities total about \$1 billion. If DOE is unable to provide funding for the privatization project when needed, the contract would likely be terminated, triggering DOE's liability to pay BNFL for the amounts borrowed against the company's assets.

DOE officials said that they did not yet have a detailed funding plan for how they would find the additional funding within their budget. However, assuming no significant increase from the Congress, DOE indicated that a major source of funds would likely be funding made available when other DOE sites, such as Rocky Flats and Fernald, are cleaned up and closed. Given DOE's track record in completing environmental cleanup projects, however, we are concerned that the funds may not be available when they are needed.

Another issue that could potentially affect DOE's ability to ensure that sufficient funding is available for the project relates to how the new contracting approach is classified in the budget. Because of budget limitations contained in the Budget Enforcement Act, cost estimates are prepared for programs, including projects in DOE's privatization program, to ensure that the limitations are not exceeded. Federal agencies such as DOE may acquire long-term assets in several ways, and each acquisition strategy may be scored differently. For example, if the federal agency offered a federal government guarantee to a private lender for a contractor's debt financing, the agency would have to estimate the subsidy cost of the loan guarantee. This is a complex process and is based on the risk of a default or nonpayment of the loans and other factors. The agency would then need the budget authority for the full net present value of the subsidy cost before it could make the guarantee.

Although the tank waste project is not structured as an explicit loan guarantee, there is an increase in the government's potential liability associated with making BNFL's loans an allowable contract cost in the case of a default. Neither DOE nor the Office of Management and Budget has estimated this potential additional cost. This scoring is of consequence because it affects how much funding DOE will have to have on hand for the project, and when.

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### Inconsistencies With Guidelines for Fixed-Price Contracts

The remediation of Hanford's tank waste is a very costly, complex, and risky effort regardless of the contracting approach DOE selects. In an effort to balance risks and realize cost savings, DOE selected a fixed-price

approach. Federal acquisition regulation guidelines note that fixed-price contracting works best when the possibility is low for changes with cost and schedule implications. However, the BNFL contract cites at least 15 events, such as regulatory changes or failure to provide waste on a timely basis, that could cause cost or schedule increases. The consequence of such changes is that they would constitute a potential basis for adjusting the fixed price or paying agreed-upon additional amounts.

Federal guidelines state that another factor contributing to the successful use of fixed-price contracting is competition, which helps determine a price that minimizes the cost to the government while providing a fair profit to the contractor. DOE's revised approach removes competition as a check on price. Without competition, DOE may not have the same assurance of obtaining the best value for the negotiated price. To compensate for the lack of competition, DOE has required BNFL to provide certified cost or pricing information for evaluating BNFL's basis for its proposed fixed-unit prices. Our reviews of DOE contracts have demonstrated that entering into a fixed-price contract is no guarantee that DOE will be successful in minimizing the cost to the government.

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## Effective DOE Oversight Is Critical to Project Success

Managing this large, complex project presents a significant challenge to DOE. The agency's continuing challenge will be to translate the plans it has made into sustainable oversight efforts that are capable of overcoming problems that have plagued many past waste cleanup projects.

DOE has had difficulty managing other large projects. Our past reviews have shown a consistent pattern of poor management and oversight by DOE. For example, in our 1996 report on DOE's major system acquisition projects (generally projects costing \$100 million or more), we reported that at least half of the ongoing projects and most of the completed ones had cost overruns and/or schedule slippage.<sup>15</sup> Some of the reasons for cost overruns and schedule slippage included inadequate project oversight and insufficient attention to technical, institutional, and management issues. In addition, our reviews of individual DOE cleanup projects such as the Defense Waste Processing Facility at Savannah River, the Pit 9 cleanup at Idaho Falls, and the Spent Fuel Storage Project at Hanford all identified problems with DOE's oversight activities as factors contributing to project difficulties.

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<sup>15</sup>See Department of Energy: Opportunity to Improve Management of Major System Acquisitions (GAO/RCED-97-17, Nov. 26, 1996).

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At least in part to respond to these past difficulties, DOE has developed several systems and processes to manage the tank waste project at Hanford and has subjected its plans to outside review. Despite these efforts, however, outstanding issues concerning technical staff, site support activities, and project administration may keep DOE from being fully prepared to oversee the project.

Technical staff: DOE has established a team eventually expected to number about 80 technical and managerial staff to oversee the project. This team, the Waste Disposal Division at Hanford, will have authority both for managing the BNFL contract and for overseeing the support activities of the contractors that provide day-to-day management of the site. As of August 31, 1998, the Division had about 30 vacancies, including key staff such as the Deputy Project Manager and five of nine DOE staff in the contract management group. DOE's Director of Contract Reform and Privatization said that the Hanford unit does not have all of the technical skills necessary to ensure success in overseeing the project. He was especially concerned about the shortage of contract expertise related to administering fixed-price contracts. According to DOE's contracting officer at Hanford, none of the current DOE staff are experts in fixed-priced contracting, although he hopes to be able to hire staff with these skills soon. Staff with these and other skills are needed very soon because DOE will be negotiating critical details of the contract, including the fixed price, during the extended design phase of the project, which is currently under way. DOE officials at Hanford plan to fill the vacancies during fiscal year 1999.

Site support activities: Also critical to project success will be the support that site contractors must provide in preparing infrastructure improvements, retrieving waste, and removing and storing the containers of vitrified material. DOE must ensure that Fluor Daniel, the main contractor managing the Hanford site, is able to provide the support necessary for the project. In August 1997, DOE directed Fluor Daniel to conduct an extensive study (called a "readiness to proceed") to determine what was needed to support the vitrification effort and to identify potential problems. At the conclusion of the study, outside reviewers commissioned by DOE and Fluor Daniel concluded that the support could be provided if adequate funding was forthcoming. However, DOE and tank farm officials said that the project is funded at about \$23 million less than needed for fiscal year 1999. DOE has requested full funding for fiscal year 2000, but the budget has not yet been finalized. According to the Director

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of the Waste Disposal Division, failure to fully fund support activities in the next couple of years could delay the project.

Project administration: Carefully administering the contract may also be critical to ensuring that DOE and the contractor work together effectively. Our review of another large cleanup project, DOE's Pit 9 project in Idaho, disclosed that substantially different views about the degree of oversight, involvement, and interaction that was appropriate for the contract were held by DOE, the contractor managing the contract for DOE, and the subcontractor responsible for carrying out the project. Due in part to this problem, the Pit 9 project has failed to meet cost and schedule targets and the parties are now involved in lawsuits to settle their claims.

In part because of the Pit 9 failure, DOE paid considerable attention to developing an approach to overseeing BNFL's operations. For example, to resolve procedural and other issues that may come up, DOE required BNFL to establish four teams specifically covering project management; contract and finance matters; interfaces; and environment, safety, and health-related matters. To help with the complicated interrelationships between DOE and its contractors, DOE has also followed a systems engineering process that involves using "interface control documents" for those areas where DOE or the site contractor have interrelationships with the BNFL contract. Overall, the project has 23 such documents covering areas such as infrastructure, emergency response, and permitting.

The contract also ensures DOE's access to key information. For example, BNFL will be conducting numerous tests to ensure that its treatment processes will work. The contract stipulates that BNFL must deliver completed test reports to DOE for numerous activities, such as validation of chemical processes, qualification of proposed products, and effectiveness of a nonradioactive pilot melter.

Finally, DOE has subjected its entire management process to both internal and external review. As a first step, in January 1998, DOE issued a self-assessment report on the Division's readiness to proceed. The report concluded that the management systems were behind schedule and identified six key actions to be taken, including revising the project management plan and developing a staffing plan. DOE then convened independent assessments to look at various aspects of the authorization to proceed. As of September 15, 1998, 20 of 91 recommendations made by the reviewers were still open, including the need to establish interfaces

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between the division and headquarters organizations and requiring training in administering fixed-price contracts.

The potential problem here is not with DOE's efforts to date but with its willingness to fully implement the oversight plans it has developed for the project. Our work over several years and on a variety of DOE activities has disclosed a consistent pattern of DOE's failure to fully implement the plans that it develops. In a number of instances, we have tied project or program difficulties directly back to these failures to implement key management and oversight components. For example, in a 1993 testimony on the environmental restoration management contract approach,<sup>16</sup> we found several DOE management and oversight weaknesses, including not fully implementing project management plans. In a 1997 report,<sup>17</sup> we found that two projects at the Fernald, Ohio, site had weaknesses, including insufficient DOE oversight of the contractor, inadequate testing of the technology, and delays in completing planning documents. These problems contributed to a \$65 million cost overrun and almost 6 years of schedule slippage. More recently, in a review of DOE's management of contaminated soils above the groundwater at Hanford,<sup>18</sup> we found that although DOE drafted a management plan by 1994, it never implemented the plan. Four years later, after admitting that the tank waste has leaked to the groundwater, DOE has still not implemented a comprehensive management strategy.

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## Conclusions

Remediating Hanford's radioactive tank waste will be difficult and very costly. In addition, given the nature of the tank waste and the challenges associated with converting it to a more stable form for long-term storage, the project involves substantial risk of encountering problems that could result in further increases in schedule and cost. Because of contract clauses that provide for adjustments in contract price, these risks are largely shouldered by DOE. Furthermore, in order to make private financing of the project feasible, DOE has also decided to pay, as an allowable cost, any debt costs that BNFL is unable to pay in case it defaults on its loans and DOE terminates the contract. As a result, DOE's potential liability could amount to several billion dollars. Given these circumstances, it is

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<sup>16</sup>DOE Management: Implementing the Environmental Restoration Management Contractor Concept (GAO/T-RCED-94-86, Dec. 1, 1993).

<sup>17</sup>Department of Energy: Management and Oversight of Cleanup Activities at Fernald (GAO/RCED-97-63, Mar. 14, 1997).

<sup>18</sup>Nuclear Waste: Understanding of Waste Migration at Hanford is Inadequate for Key Decisions (GAO/RCED-98-80, Mar. 13, 1998).



important that DOE have in place a skilled project oversight team fully prepared to face the challenges ahead. However, problems already exist in implementing the staffing plan and securing adequate funding for the contract's support services. We are concerned that if these problems are not addressed quickly, they may adversely affect the project. Although a contract has been signed, the \$6.9 billion is an estimated cost because design and financing issues have not been finalized and the final unit price has not been set. Since this important information will be developed over the next 21 months, the end of the design phase in August 2000 is another critical point to assess the project before the most significant project costs are incurred.

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## Recommendation

We recommend that the Secretary of Energy take immediate action to fully implement the Department's management and oversight plan for the Hanford tank waste project, including ensuring that (1) the oversight team is fully staffed with the expertise required and (2) adequate funding is available to provide the site support services called for in the contract.

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## Matters for Congressional Consideration

Because key aspects of the project and the associated contract are still being developed, significant changes in project cost, schedule, and overall approach could occur before the price is set. The end of the extended design phase in August 2000 provides another decision point at which these and other aspects of the project could be reviewed before the most significant project costs are incurred. Therefore, the Congress may wish to require DOE to include in its annual status report on privatization contracts (1) the results of BNFL's technology demonstration and testing using Hanford's waste, (2) a reassessment of the cost-effectiveness of the proposed approach including the results of DOE's analysis of different financing alternatives, and (3) DOE's overall preparedness to effectively oversee the project.

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## Agency Comments

We provided a draft of this report to DOE for review and comment. DOE generally agreed with the report's conclusions and recommendations and also provided several comments and technical clarifications to the report. The full text of DOE's comments and our evaluation of them are included in Appendix I.

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## Scope and Methodology

To determine how DOE's current project strategy has changed from the original proposal, we reviewed the contract between DOE and BNFL and DOE's report issued to the Congress in July 1998. We also reviewed DOE, BNFL, and other contractor documents related to the tank waste project. In addition, we interviewed DOE and contractor officials at Hanford and in Washington, D.C., to discuss the changes in the contract.

To determine how the project's schedule, cost, and savings estimates have changed from the original proposal, we reviewed DOE's documentation providing original schedule, cost, and savings estimates and compared those to the current contract as outlined in the report to the Congress. We also interviewed DOE and BNFL officials and outside financial experts to understand the changes that have occurred to the project's schedule, cost, and savings estimates.

To determine the risks that DOE is now assuming with the change in contract approach, we analyzed the contract, DOE's report to the Congress, and DOE and contractor documents describing the risks to the project. We also interviewed those officials, in addition to officials at the Office of Management and Budget and the Congressional Budget Office to discuss the risks and budget issues associated with the change in contract approach.

To determine the steps that DOE is taking to carry out its responsibilities for overseeing the project, we reviewed DOE's report to the Congress describing how the Department is organized to manage the project, as well as Department and contractor plans for managing the project. In addition, we reviewed internal and outside assessments of DOE's efforts to oversee the project. Finally, we interviewed contractor and DOE officials, including the Director of DOE's Office of Contract Reform and Privatization.

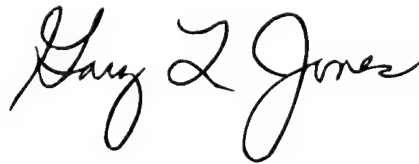
Our review was performed from June through September 1998 in accordance with generally accepted government auditing standards.

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We are sending copies of this report to the Secretary of Energy. We will also make copies available to others on request.

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Please call me at (202) 512-8021 if you or your staff have any further questions. Major contributors to this report were Chris Abraham, John Cass, Dwayne Curry, Doreen Feldman, Susan Irwin, Nancy Kintner-Meyer, Tom Perry, Tim Schindler, Stan Stenersen, and William Swick.

A handwritten signature in black ink that reads "Gary L. Jones". The signature is written in a cursive, flowing style.

(Ms.) Gary L. Jones  
Associate Director  
Energy, Resources, and  
Science Issues



# Comments From the Department of Energy and GAO's Evaluation

Note: GAO comments supplementing those in the report text appear at the end of this appendix.



## Department of Energy

Washington, DC 20585

Ms. Gary L. Jones  
Associate Director, Energy, Resources, and Science Issues  
U.S. General Accounting Office  
Washington, D. C. 20548

Dear Ms. Jones:

Thank you for the opportunity to comment on your report entitled "Nuclear Waste: Department of Energy's Hanford Tank Waste Project--Schedule, Cost, and Management Issues" (GAO/RCED-99-13), October 1998. In general, we agree with your conclusions and recommendations. Enclosed are the Department's comments on the draft report.

Protecting the Columbia River from the threat posed by the radioactive wastes stored in underground tanks at the Hanford Site is one of the Department's highest priorities. Cleaning up these wastes is one of the most urgent and complex problems faced by the Department. There are approximately 54 million gallons of highly radioactive wastes stored in 177 underground tanks, including 149 older single-shell tanks, most of which have exceeded their design life. There have been leaks in the past from these tanks -- about a million gallons of the tank waste have moved into the vadose zone, and a recent study suggests that volume may actually be as much as 40% higher. And the Department confirmed with monitoring data last year that tank waste radionuclides have moved through the vadose zone and now have reached the groundwater that connects with the Columbia River.

The Hanford Tank Waste Remediation System (TWRS) project provides a significant step forward in addressing urgent and complex problem. The contract signed in August 1998 with BNFL, Inc. provides a viable path forward for the treatment of the waste, converting it to a safe and environmentally sound waste form. We believe this contract offers a means to treat the waste cost-effectively, but we also fully recognize the technical, financial, and management uncertainties and risks inherent in the project.

As GAO noted, the Department did alter its original strategy for awarding the contract into the construction and operations phase of the project. The contractual approach we have taken divides Part B into two subparts that were not originally contemplated: (1) a 24-month design phase and (2) a subsequent phase in which the design will be completed and a treatment facility will be constructed and operated. The 24-month design phase will be conducted under a fixed price plus incentive fee arrangement with BNFL and will be completed in August 2000. During this period, DOE and BNFL will refine the technical requirements, further clarify the regulatory requirements, and finalize the project's financial and incentive structure. At the end of this phase, final prices will be set and the DOE will decide on whether to proceed to the construction and operations phase. This new element to the Department's procurement strategy will reduce uncertainties and, in contrast with the original contracting approach, provide significantly



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Appendix I  
Comments From the Department of Energy  
and GAO's Evaluation

more information about all project elements before a decision is made to initiate the construction and operations portions of the project.

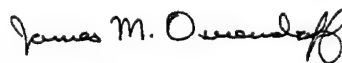
We believe this approach for TWRS represents the best available value for the taxpayer and offers the best chance for success. The contract with BNFL, Inc. builds on its promising technical approach and includes future options for expanding facility capacity to complete most or all of the TWRS mission. It places strong performance incentives on BNFL and provides for only limited payment until the waste is successfully treated. DOE's path forward includes a series of explicit decision points over the next 24 months that will allow optimization of the approach and will maintain a level of competitive pressure on BNFL, Inc. by allowing DOE to continue to explore alternative approaches. Certified cost and pricing data will be provided by BNFL and will help DOE ensure that only appropriate costs are included in the final fixed-unit prices. Not only will this requirement compensate for the reduced competition in Part B but it will also increase the lenders' expectations for operational efficiencies..

Costs have increased approximately \$3.7 billion in constant FY 1997 dollars over the original estimates for this privatization approach. The original concept outlined in the 1995 Request for Proposal was to construct up to two 5- to 9-year demonstration facilities, but the hazards associated with the waste operations necessitated going to a more robust design. Under the current strategy, the plant to be constructed has a longer design life and the potential to treat waste for a longer period and with a broader range of composition. Also, greater volume of waste will be treated in this phase of the project.

We recognize the importance of having a skilled project oversight team in place and accept the challenges associated with establishing this team. We have been in the process of establishing a separate office to manage the Project. The structure of this office will be consistent with the requirements in the FY 1999 National Defense Authorization Act to create an Office of River Protection. In addition, we have developed the strategy and plan for ensuring that funds are provided for the support services that will be needed by BNFL, Inc.

Ralph Lightner of my office is available to discuss our concerns and comments. He can be reached at 301/903-3791.

Sincerely,



James M. Owendoff,  
Assistant Secretary for  
Environmental Management

Enclosure

**ENCLOSURE**

Additional Comments on GAO Report "Nuclear Waste: Department of Energy's Hanford Tank Waste Project--Schedule, Cost, and Management Issues" (GAO/RCED-99-13), October 1998.

Additional comments and suggestions on the report are as follows:

- **Page 8 - Competition**

It is import to elaborate the extent, duration, and benefits of the competition that occurred under this project for Part A and Part B until we authorized BNFL to proceed in Part B1. Competition, also depicted in Table I on page 7, played an important role early on in this project. These included global announcement of the request for proposals, proposal evaluations, and negotiations. Part A contracts were awarded to LMAES and BNFL, Inc. in September 1996. During the course of Part A of the contracts, DOE evaluated contractor deliverables and negotiated contract terms. If BNFL, Inc., is authorized to proceed to the construction and operations phase, the Department will maintain its ability to compete the contract or portions of the contract at key points during the course of the project. A key benefit of competition is reduced costs. Thus, to gain this benefit under the BNFL contract, the Department has instituted contractual requirements to help control and reduce BNFL, Inc., prices for services. These include requirements for BNFL to provide certified cost and pricing data, incentives to reduce construction and operations costs, and price adjustment controls throughout the life of the project.

- **Page 8 - Financial Issues**

The DOE will evaluate the need to commit resources to cover recourse debt lending from banks and other lending institutions. This will help BNFL obtain financing from private lenders and reduce the interest associated with the private financing which ultimately reduces the cost of the project. However, the debt structure places significant levels of private equity and debt at risk prior to DOE being adversely impacted. BNFL would be unable to obtain sufficient private financing from lenders without some government commitment.

- **Page 8 - Payment**

It is important to note that the \$ 50 million payment during the 24-month design phase depicted in Table 1 on page 7 is an incentive fee payment and is not a progress payment. BNFL will only receive this fee payment upon receipt by the DOE of specific deliverables which are provided in Part B1. This is consistent with general privatization principles of payments for deliverables. BNFL Inc.'s B-1 costs, estimated at \$250-300M, are not covered with this \$50M fee payment; BNFL, Inc.'s costs will be rolled forward to the construction and operations phase and be included in the price paid for waste treatment



services.

- **Page 11 - Extended Schedule**

In discussing changes to the project schedule, it is important to mention the acceleration of the Tri-Party Agreement (TPA) milestone for treating HLW. The start of HLW pretreatment and vitrification with BNFL's target schedule would occur more than two to three years early (between February 2006 and February 2007) under the BNFL contract. The BNFL target schedule would, however, require some changes in near-term TPA milestones. The milestone was accelerated because the BNFL HLW facility can be brought on-line earlier than the LAW facility. For LAW vitrification, the melter size needs to be significantly larger than for HLW. A pilot melter demonstration will be conducted by BNFL prior to finalizing the facility design resulting in a longer design period for LAW vitrification than for HLW vitrification.

- **Page 14, Table 3 - Changes in Costs Estimates**

Three points regarding Table 3 are important to clarify. First, the original estimate was based on five to nine year "throw-away" pilot plants which was found to be unrealistic, given neither bidder was willing to consider a privately financed approach for such facilities (due largely to nuclear safety issues). Second, the plant is designed for a longer life which would cost more up-front to build than would small "throw-away" plants to process the same quantity of product. However, the 30 to 40 year plant is designed to process several times more quantity of product. Thus, ultimately the unit cost should be less than the unit cost using small "throw-away" plants. Finally, the table should compare the two approaches on a present value basis. The two time frames are quite different which requires a present value analysis.

Regarding the statement that direct federal funding of the project may actually lower total project costs without significantly increasing the government's level of risk, it is important to note that while project costs may be lower, we believe that this will be accompanied by a significant increase in the government's level of risk. The determination of how much direct federal funding might be used will require an analysis of any potential savings related to finance charges as well as an assessment of the potential costs associated with the increase in the government's risk. This assessment will be accomplished during the next phase of the project.

- **Page 16 - Footnote 7**

Footnote 7 references a 1993 Independent Project Analysis, Inc., study that found that actual costs of fixed price contracts exceeded the estimated costs by 75 percent. The footnote should also indicate the reason for the increased actual costs - fixed price contracts were inappropriately used in the instances studied by IPA, Inc. Fixed price contracts were used on poorly defined projects, which led to changes during construction contributing to increased costs and schedule. This is not the situation with TWRS

privatization.

- **Pages 24 and 25 - DOE Support Costs**

The two risks associated with the DOE's support activities are inaccurately stated. The availability of double-shell tank space is not a major uncertainty for feed delivery for Phase I. Waste feed to the waste processing plants will come almost entirely from double-shell tanks in Phase I with waste from only one single-shell tank used for HLW feed. DST space will definitely be an area of high risk for Phase II, when the remaining SSTs will be retrieved into DSTs.

Also, our assessment of readiness to proceed with the BNFL contract identified high schedule risk in the storage and disposal facilities for supporting a 2002 start up, as there was no float in the schedule. However, that risk is greatly reduced by the new 2007 hot start date. The revised schedule for the Spent Nuclear Fuel Project indicates that project will have completed moving the SNF into the Canister Storage Building early in 2004, fully three years before the first immobilized high-level waste canisters are produced by BNFL.

DOE is well aware that there are risks in supporting privatization, and is clear on its responsibilities for providing major support to the waste processing plants in the areas of infrastructure, waste feed, and immobilized product storage facilities. Moreover, DOE is carrying out an aggressive risk management program to ensure those responsibilities are carried out successfully.

The following are GAO's comments on DOE's letter.

Regarding our comments on the lack of competition for the remainder of phase I, DOE emphasized that competition played an important role in reducing costs early in the project and that DOE had instituted other controls on the BNFL contract to help control and reduce costs such as requiring certified cost or pricing data. DOE also emphasized that its decision to back BNFL's debt was essential for BNFL to obtain private financing for the project. We believe our report adequately states these views.

Concerning the payment of up to \$50 million that DOE will make during the extended design phase, DOE stressed that the payment will be made only for specific deliverables under the contract and that DOE does not consider this to be a progress payment. We clarified this in our report.

DOE said that it was important to mention that the revised project schedule actually accelerated by 2 to 3 years the milestone for beginning to treat high-level waste as set forth in the Tri-Party Agreement. We modified the report to clarify that some milestones would be delayed while one milestone, the date to start high-level waste processing, would be advanced.

Regarding the changes in cost estimates, DOE said that the two approaches involved processing plants of substantially different useful lives and, therefore, capacity, which would ultimately bring down the unit cost of operation. We presented processing quantities and costs only for phase I because the current contract is only for phase I and BNFL intends to recover all of its costs during phase I operations. Costs related to phase II operations are not known. DOE also said the cost estimates for phase I should be compared on a present-value basis because the two time frames are quite different. Our analysis does compare the two costs on a present-value basis, in constant fiscal year 1997 dollars.

DOE disagreed with our statement that direct federal funding of the project may not significantly increase the government's level of risk. DOE said that direct federal funding would be accompanied by a significant increase in the government's level of risk. However, it is not clear how much of an increase in risk there is between private debt which is in effect guaranteed by the government and direct federal funding of the project. DOE did not quantify this difference in risk or compare it to the significantly lower financing costs that could be achieved through direct federal funding of

the project. Our point was that DOE needs to conduct such an analysis in order to ensure that it has a cost-effective approach to funding the project. DOE said that this analysis will be accomplished during the next phase of the project.

DOE said that our reference to a 1993 study by Independent Project Analysis, Inc., was incomplete because we did not mention the reason why cost growth on fixed-price contracts averaged 75 percent. The study found that fixed-price contracts were used on poorly defined projects, which led to changes during construction contributing to increased costs and schedules. DOE asserted that a similar condition does not exist on the Hanford tank waste contract. We added to our report the causes for cost growth identified in the study. However, we disagree with DOE's assertion that similar conditions do not exist on the Hanford project. Instead, the project risks and uncertainties we discuss in this report increase the chances that the Hanford tank waste project could also experience cost and schedule increases.

Finally, DOE felt that we inaccurately stated the risks associated with two DOE support activities—waste retrieval and storage of high-level waste. DOE said that Phase I waste will come almost entirely from double-shell tanks and, therefore, tank capacity for storage and transfer of the waste should not be a problem. However, sufficient double-shell tank space must be available to blend and stage the waste before delivering it to BNFL in batches. In May 1998, the Hanford Site support contractor determined that there was a high risk of having inadequate tank storage capacity to meet the needs of this project and at the same time support other site initiatives such as the project to pump liquids from single shell tanks into the double-shell tanks and the need to continue to receive waste into the tanks from other Hanford activities. As part of the multi-year planning process, the contractor is currently reevaluating this issue.

Regarding the on-site storage of high-level waste, DOE is correct in saying that the risk of having a problem is reduced by the extended schedule. However, DOE's contractor still described it as a high risk in May 1998 due to the modifications required to the storage building which will have to be made during the same years that the spent fuel program is moving its canisters into the building.

While DOE may be correct that potential waste retrieval and storage problems can be managed, they clearly represent a risk to the project and illustrate the need for an aggressive risk management effort.

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